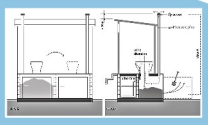
Dehydration Vaults

العربية (/ar/sanitation-systems/sanitation-technologies/dehydration-vaults)

Applicable to	Application level	Management level	Inputs	Outputs
System 4 (/sanitation-systems/sanitation-systems/system-4%3A-waterless-system-with-urine-diversion)	City Household Neighborhood	Household Public Shared	Faeces + Dry Cleansing Materials	Dried Faeces



Author/Compiled by
Eawag (Swiss Federal Institute of Aquatic Science and Technology)
Dorothee Spuhler (seecon international gmbh)

Adapted from

Compendium of Sanitation Systems and Technologies. 2nd Revised Edition (/node/5587)

Executive Summary

Dehydration vaults are used to collect, store and dry (dehydrate) faeces. Faeces will only dehydrate when the vaults are well ventilated, watertight to prevent external moisture from entering, and when urine and anal cleansing water are diverted away from the vaults.

Advantages

- Because double vaults are used alternately, their life is virtually unlimited
- Significant reduction in pathogens
- Potential for use of dried faeces as soil conditioner

Disadvantages

- Requires training and acceptance to be used correctly
- Requires constant source of cover material
- Manual removal of dried faeces is required

- No real problems with flies or odours if used and maintained correctly (i.e., kept dry)
- Can be built and repaired with locally available materials
- Suitable for rocky and/or flood prone areas or where the groundwater table is high
- Low (but variable) capital costs depending on materials; no or low operating costs if self-emptied

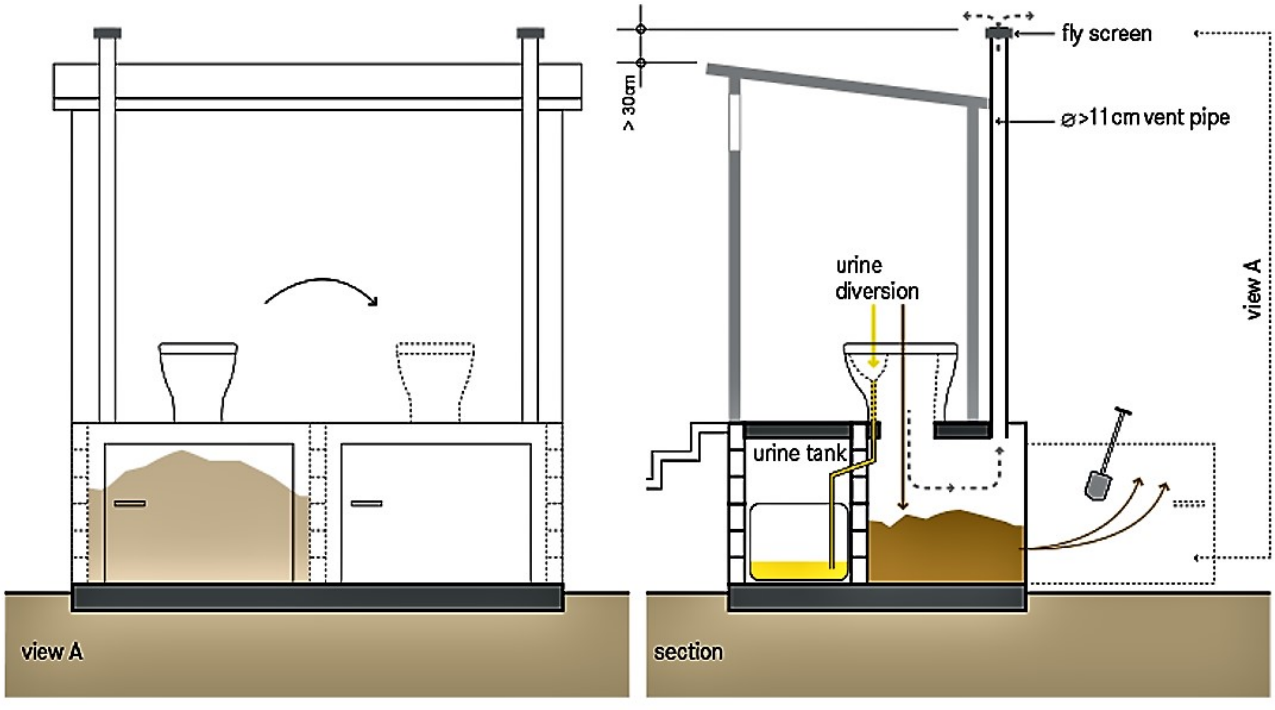
In	Out
Faeces, Dry Cleansing Materials	Dried Faeces, Compost/Biosolids

Introduction

When faeces are not mixed with urine and other liquids, they dry quickly. In the absence of moisture, organisms cannot grow, pathogens are destroyed and smells minimized.

The use of two alternating vaults in allows the faeces to dehydrate in one vault while the other vault fills. When one vault is full, the Urine-Diverting Dry Toilet (**UDDT (/taxonomy/term/2660/uddt)**) is moved to the second vault. While the second vault fills up, the faeces in the first vault dry and decrease in volume. When the second vault is full, the first one is emptied and put back into service.

To prevent flies, minimize odours and encourage drying, a small amount of ash, lime, dry soil or sawdust should be used to cover faeces after each use.



Schematic of the dehydration double vaults. Source: TILLEY et al. (2014)

Design Considerations

Dehydration vaults can be constructed indoors or with a separate superstructure. A vent pipe is required to remove humidity from the vaults and control flies and odours. The chambers should be airtight for proper functioning of the ventilation. They should be made of sealed brickwork or concrete to ensure that surface runoff cannot enter.

The WHO recommends a minimum storage time of 6 months if ash or lime are used as cover material (alkaline treatment), otherwise the storage should be for at least 1 year for warm climates (>20 °C average) and for 1.5 to 2 years for colder climates.

In case of alkaline treatment, each vault is sized to accommodate at least 6 months of faeces accumulation. This results in a 6 month storage and dehydration time in the out-of-service vault. The vault dimensions should account for cover material, airflow, the non-even distribution of faeces, and possibly visitors and dry cleansing materials. It can be assumed that one person will require around 50 L of storage volume every 6 months. A minimum chamber height of 60 to 80 cm is recommended for easy emptying and access to the urine pipes.

Health Aspects/Acceptance

Dehydration vaults can be a clean, comfortable, and easy-to-use technology. It is crucial, however, that the users are well trained to understand how the technology works and appreciate its benefits.

When the vaults are kept dry, there should not be any problems with flies or odours. After the recommended storage time, the faeces should be very dry and relatively safe to handle, provided that they did not get wet. However, a low health risk remains. Single dehydration vaults or bins do not allow faeces to sufficiently dehydrate. When the full container needs emptying, the faeces on top are still fresh. Hence, the risk associated with the handling of faecal matter is inherently higher in single vaults compared to double vault designs. The use of alternating chambers is, therefore, recommended. However, research and field tests of sealed faeces containers (or cartridges) for safe transportation and easy cleaning, along with the corresponding logistics, are on-going.

Operation & Maintenance

Just like the faeces, which are dried, but not degraded in the vaults, dry cleansing materials will not decompose in the chambers. Whenever the material is intended to be applied onto fields without further treatment, it is recommended to separately collect and dispose of the dry cleansing materials. Occasionally, the faeces that have accumulated beneath the toilet should be pushed to the sides of the chamber.

Care should be taken to ensure that no water or urine gets into the dehydration vault. If this happens, extra ash, lime, soil or sawdust can be added to help absorb the liquid.

To empty the vaults, a shovel, gloves and possibly a facemask (cloth) should be used to avoid contact with the dried faeces.

Applicability

Dehydration vaults can be installed in almost every setting, from rural to dense urban areas, because of the small land area required, minimal odours and ease of use. If used in an urban context, this technology relies on a transport service for the dried faeces (and urine) since urban users normally do not have an interest and/or opportunity to use it locally. Dehydration vaults are especially appropriate for water-scarce and rocky areas or where the groundwater table is high. They are also suitable in areas that are frequently flooded because they are built to be watertight.

Library References

Urine Diverting Toilets Principles, Operation and Construction

All about dry urine diversion toilets, from the principles, design, construction and operation

DEGENER, S. SAMWEL, M. GABIZON, S. (2006): Urine Diverting Toilets Principles, Operation and Construction. Utrecht/Munich: Women in Europe for a Common Future (WECF) **URL (https://bibalex.org/baifa/en/resources/document/356056)** [Accessed: 01.06.2019]

Technology Review of Urine-Diverting Dry Toilets (UDDTs)

This publication offers a complete overview of UDDT functions, design considerations, common operation and maintenance issues and generalised installation costs. Its focus is on applications in developing countries and countries in transition, although UDDTs are also applicable in developed countries.

RIECK, C. MUENCH, E. HOFFMANN, H. (2012): Technology Review of Urine-Diverting Dry Toilets (UDDTs). Overview on Design, Management, Maintenance and Costs. (= Technology Review). Eschborn: German Agency for Technical Cooperation (GTZ) GmbH **URL (https://www.susana.org/en/knowledge-hub/resources-and-publications/library/details/874)** [Accessed: 11.05.2019]

Ecological Sanitation - revised and enlarged edition

This book is one of the most fundamental and important books that defined the concept of ecological sanitation. The first version came out in 1998 - this version presents the findings of over ten years of research and development in ecological sanitation supported by SIDA (Swedish International Development Cooperation Agency).

WINBLAD, U. SIMPSON-HERBERT, M. (2004): Ecological Sanitation - revised and enlarged edition. (pdf presentation). Sweden: Stockholm Environment Institute **URL (http://www.ecosanres.org/pdf_files/Ecological_Sanitation_2004.pdf)** [Accessed: 04.08.2010]

Guidelines for the safe use of wastewater excreta and greywater. Volume IV. Excreta and Greywater Use in Agriculture

Volume IV of the Guidelines for the Safe Use of Wastewater, Excreta and Greywater recognizes the reuse potential of wastewater and excreta (including urine) in agriculture and describes the present state of knowledge as regards potential health risks associated with the reuse as well as measures to manage these health risks following a multi-barrier approach.

(/sites/default/files/reference_attachments/WHO%202006%20Guidelines%20for%20the%20safe%20use%20of%20wastewater%20excreta%20and%20greywater%20Volume%20IV.pdf) PDF (/sites/default/files/reference_attachments/WHO%202006%20Guidelines%20for%20the%20safe%20use%20of%20wastewater%20excr

WHO (2006): Guidelines for the safe use of wastewater excreta and greywater. Volume IV. Excreta and Greywater Use in Agriculture. Geneva: World Health Organisation (WHO) **URL (https://www.who.int/water_sanitation_health/publications/gsuweg4/en/)** [Accessed: 09.05.2019]